

# Solar Harvest Net-Zero Energy Home

Boulder, Colorado

Update #1, September 9, 2008

## ***In this update***

1. Solar Harvest converted to all-electric home: Summer 2007
2. Year 1 energy performance verification summary & total annual energy use
3. Solar Harvest cooling season net-energy study
4. Data monitoring system overview

## ***Highlights***

- Solar Harvest produced 1,165 kWh more than it consumed for its first full year as an all-electric home (and could have powered an all-electric car over 4,000 miles)
- Solar Harvest thermal performance continues to exceed expectations: with the Coolerado air conditioner going full time in July 2008, Solar Harvest still used only about 660 kWh and produced 1095 kWh, for a net production of 435 kWh.
- The total annual energy use for all purposes, including lighting, appliances, HVAC, spa and plug loads is 2.19 kWh/ft<sup>2</sup>

## ***Background***

In April 2007, EcoGauge data monitoring providers teamed up with Boulder-based Continental Control Systems to outfit Solar Harvest with energy and environmental performance sensors. This advanced equipment immediately began sending live data signals to the web, making Solar Harvest the first net-zero energy home nationwide to have live performance verification data available to the public.

Over the summer of 2007 Solar Harvest underwent necessary changes to become an all-electric net-zero energy home, so September 2007 marked the start of our first complete year of data monitoring. Visit our website to see the live monitor and download energy data (<http://www.ecofuturesbuilding.com/systemsmonitoring>).

## ***1. All-Electric Home Conversion***

Throughout the summer of 2007, Solar Harvest underwent several changes to convert the home to be an all-electric consumer, and to upgrade the home's energy and comfort systems:

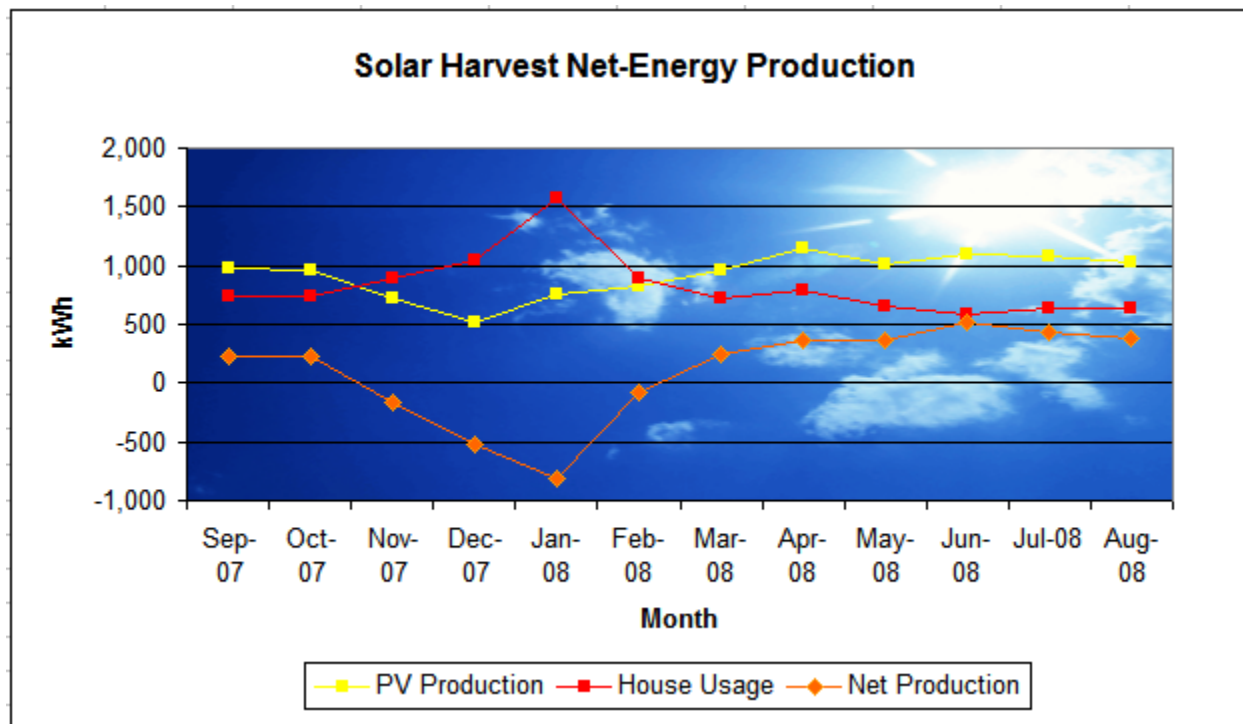
- Natural gas clothes dryer and stove appliances were replaced with electric alternatives
- The natural gas line was capped, and meter removed from the property
- Coolerado energy efficient cooler installed
- 1.9 kW east- and west-facing PVs installed on the garage
- Fishtank removed, allowing Solar Harvest an additional energy budget of 1,600 kWh/year

## 2. Year 1 Energy Performance Verification Summary

Because all stages in the all-electric home conversion was completed by August 31, 2007, that date marks start of our first full year of data monitoring as an all-electric home. We are proud to announce that the data collected over the past year supports what we have known is true: Solar Harvest is a net-energy producer.

### 2007-2008 Solar Harvest NZEH Monitored Data Results

September 1, 2007 – August 31, 2008\*



### 2007-2008 Solar Harvest NZEH Monitored Data Results Summary Table

September 1, 2007 – August 31, 2008\*

|              | PV Production | House Demand | Net Energy   |
|--------------|---------------|--------------|--------------|
| September-07 | 969           | 747          | 223          |
| October-07   | 956           | 736          | 219          |
| November-07  | 728           | 887          | -159         |
| December-07  | 517           | 1,046        | -529         |
| January-08   | 757           | 1,569        | -812         |
| February-08  | 822           | 897          | -76          |
| March-08     | 967           | 720          | 246          |
| April-08     | 1,150         | 787          | 362          |
| May-08       | 1,009         | 651          | 359          |
| June-08      | 1,098         | 584          | 514          |
| July-08      | 1,071         | 636          | 435          |
| August-08    | 1,021         | 640          | 381          |
| <b>Total</b> | <b>11,064</b> | <b>9,899</b> | <b>1,165</b> |

\* September 1, 2007 - August 31, 2008 was selected as the first year annual energy summary date range because this range accurately tracks energy used when the home is fully all-electric.

The Solar Harvest NZEH Results Summary Table illustrates that at the end of a full year, Solar Harvest produced a surplus of 1,165 kWh.

A surplus of 1,165 kWh could have:

- Driven an all-electric car 4,369 miles (at 3.75 mi/kWh)
- Saved Eric Doub & his family 97 gallons of diesel (@ 45 mpg)
- Which means, Eric could have saved \$439 worth of diesel last year!

A surplus of 1,165 kWh sent to the grid also means:

- 3,495 kWh not produced at Xcel's power plants for use in other homes
- 2,085 lbs CO2 avoided from being produced for use in other homes

\* Add this to the CO2 emissions avoided because Solar Harvest consumed of solar energy for most of its needs throughout the course of the year, and Solar Harvest prevented **17,422 lbs of CO2** from entering the atmosphere!

### Energy Use Summary

The total annual energy use for all purposes, including lighting, appliances, HVAC, spa and plug loads is 2.19 kWh/ft<sup>2</sup>

### 3. 2008 Solar Harvest Cooling Season Net-Energy Summary

July 2008

|           | PV Production | Energy Bought From Grid | Net Energy |
|-----------|---------------|-------------------------|------------|
| June-08   | 1,098         | 584                     | 514        |
| July-08   | 1,071         | 636                     | 435        |
| August-08 | 1,021         | 640                     | 381        |

July 2008: Solar Harvest is net-energy producer, despite using cooling system set to 72°F 24/7 during a heat wave with 23 days over 90°F

During the month of July, 2008 Solar Harvest met the goal of being a net-energy producer. This data points out the phenomenal thermal performance of the home, and of the Coolerado Cooler, whose installation faced some initial criticism from builders and spectators of the net-zero energy home world.

Even with the Coolerado air conditioner going full time in July 2008, Solar Harvest used consumed about 660 kWh and produced 1095 kWh, for a net production of 435 kWh. That is a very powerful metric: That a 4,500 SF house, cooled to 72F, 24/7, in a heat wave with over 23 days over 90F, used only 660 kWh!

## 4. Data Monitoring System Overview

The energy side of Solar Harvest’s data monitoring system featured in this performance update is centered around a web energy logger that connects to 2 “Watt Node” Pulse Output Meters provided by [Continental Controls Systems](http://www.ccontrols.com/) (figure 1). The WattNodes track energy produced and consumed by the house and send signals to a live webpage that is updated every 60 seconds and to downloadable excel spread sheets. It is using these numbers of PV production, household consumption and excess energy “sold” to the grid that we can most accurately judge whether Solar Harvest has met its net-energy goal.



Figure 1: WattNode by [Continental Control Systems](http://www.ccontrols.com/)  
(<http://www.ccontrols.com/>)

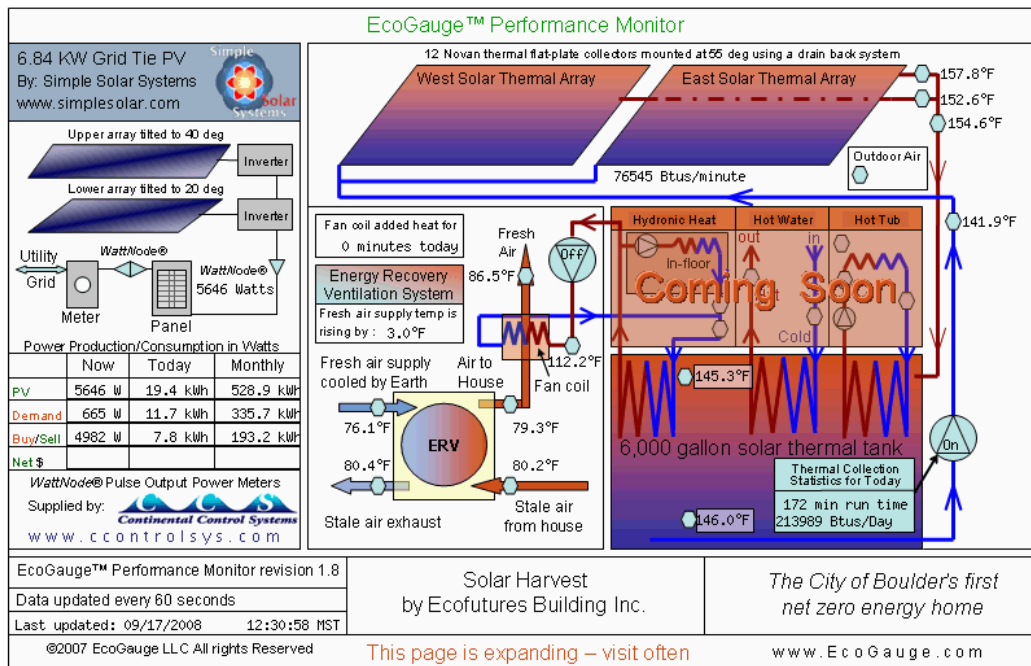


Figure 2: Snapshot of Solar Harvest’s live energy monitoring page  
(<http://www.ecofuturesbuilding.com/systemsmonitoring>)

NEXT UPDATE: Daily peak energy data

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